

PHOTOPERIODIC REACTION OF THE HOKKAIDO POPULATION  
OF *PAPILIO BIANOR DEHAANII* C. ET R. FELDER  
(LEPIDOPTERA : PAPILIONIDAE)

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Diapause in the swallowtail butterfly, *Papilio bianor dehaanii* C. et R. Felder, occurs in the pupal stage. This diapause is though to be induced by a short photoperiod during the larval stage like in *Papilio xuthus* L. (Hidaka and Hirai, 1970). The present paper deals with the photoperiodic reaction in the Hokkaidô population of *P. bianor dehaanii* which inhabits near the northern limit of this species.

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#### Materials and Methods

Eggs were obtained from a female captured in Tomakomai in Hokkaidô (42.5°N 141.5°E) on the 22nd of July in 1974. Hatching 1st-instar larvae were divided into 8 groups of 12 individuals each and reared under following photoperiodic conditions: 16L8D, 15L9D, 14.5L9.5D, 14L10D, 13.5L11.5D, 13L11D, 12.5L11.5D and 12L12D.

Larvae were reared in the transparent plastic cases (9 cm in diameter, 3 cm in depth), 12 individuals per each at younger stages and 3-5 individuals at older stages. As rearing was made in the non-temperature controlled room, temperature varied from 24°C to 32°C. Photoperiod was controlled by putting the cases on the table illuminated by a 20 watt fluorescent lamp and putting them in lighttight paper boxes. Fresh leaves of their food plant, Karasunosanshō, *Fagara ailanthoides*, were given as the diet.

#### Results and Discussion

Results of experiments were given in Table 1. Mortality rate of larvae under 13L11D, 13.5L10.5D and 14L10D photoperiods were higher than other conditions.

Pupae were regarded as diapausing when they did not emerge within a month after pupation and

Table 1: Results of experiments on the photoperiodic reaction of the Hokkaidô population of *Papilio bianor dehaanii* C. et R. Felder.

Conditions	N	No. of Pupae Obtained			Dead	Incidence of Diapause (%)
		Total	Non-dia-pausing	Dia-pausing		
16L8D	12	9	6	3	0	33.3
15L9D	12	11	3	5	3	62.5
14.5L9.5D	12	11	0	7	4	100.0
14L10D	12	4	0	4	0	100.0
13.5L10.5D	12	6	0	5	1	100.0
13L11D	12	3	0	1	2	100.0
12.5L11.5D	12	9	0	5	4	100.0
12L12D	12	9	0	6	3	100.0

as non-diapausing when they emerged within two weeks.

Figure 1 represents the results in a photoperiodic reaction curve. The critical daylength is inferred to be about 15.5 hours and diapause occurs in all the individuals reared under a photoperiod below 14.5 hours. In Tomakomai, larvae experience 15.5 hours daylength at the beginning of August and 14.5 hours daylength at the end of the month (the daylength between sunrise and sunset plus the civil twilights. Beck, 1968). Therefore, all the larvae hatching later than the end of August are destined to enter the pupal diapause. The critical daylength of 15.5 hours is much longer than that of *Papilio xuthus* L. of Tokyo population which is known to be a little shorter than 13 hours (Hidaka and Hirai, 1970).

More interesting fact, however, is that diapause occurs in one-third of pupae even under 16L 8D photoperiod. It is not known whether this represents a fluctuation in photoperiodic reaction or suggests genetically determined diapause independent of photoperiodic conditions, or again the intervention of other environmental factors as in the Colorado beetle, *Leptinotarsa decemlineata* (Danilevskii, 1961).

This phenomenon seems to explain the appearance of diapausing pupae in the first (summer) generation reported by Ae (1971). Occurrence of diapausing pupae in the first generation is observed in other species of Papilionids, such as *Papilio helenus nicconicolens* (Ae, 1971), *P. machaon hippocrates*, *Graphium sarpedon nipponum*, *G. doson albidum* and *Byasa alcinous* (Shirôzu, 1965). In these species, the population consists of at least two different types of individuals with respect to the photoperiodic reaction.

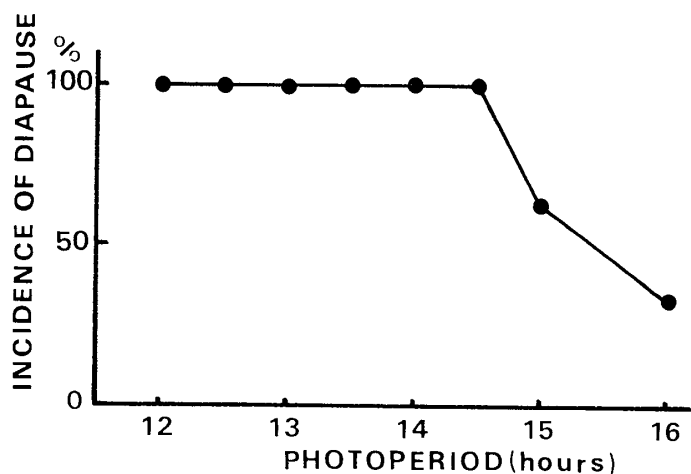


Fig. 1. Photoperiodic reaction curve of the Hokkaidô population of *Papilio bianor dehaanii* C. et R. Felder.

## References

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## 要 約

北海道苫小牧産のカラスアゲハ *Papilio bianor dehaanii* C. et R. Felder の幼虫をさまざまな光周条件下で飼育した(温度: 24°C-32°C). その結果, 1) 蛹休眠の生じる臨界日長は約15時間30分と長く, 14時間30分より短い日長では, すべての個体が休眠に入ること, 2) 16時間の長日条件下でも3分の1ほどの個体が休眠に入ること, がわかった (Fig. 1). このような長日下で休眠に入る蛹は一部のアゲハ類で知られているような, 第一世代の休眠蛹に相当するものと考えられる.